Claims

What is claimed is:

1. An adaptive resonant power converter comprising:

a gate drive transformer comprising a first sensing primary winding, a first secondary winding, and a second secondary winding;;

a first MOSFET having a gate connected to said first secondary winding;

a second MOSFET having a gate connected to said second secondary winding;

said first and second MOSFETS connected to each other in series across a direct current input source and forming a common MOSFET node therebetween at said first MOSFET source and said second MOSFET drain;

a main transformer comprising a primary winding and a first resonant output winding;

an input capacitor having a first capacitor node connected to said first MOSFET drain and a second capacitor node connected to said main transformer primary winding;

said main transformer primary winding connected between said common MOSFET node and said second capacitor node; and

wherein a first tap of said first resonant output winding is connected to a first tap of said first sensing primary winding, a second tap of said first resonant output winding is connected to a first load terminal of a first load, and a second tap of said first sensing primary winding is connected to a second load terminal of said first load.

2. The converter according to claim 1 wherein said switching transformer further comprises a protection diode winding connected in parallel with a pair of parallel voltage limiting diodes, said voltage limiting diodes having opposite orientations.

3. The converter according to claim 1 further comprising:

a first rectifier diode connected between said first resonant output winding and said first load terminal;

a second output circuit having second resonant output winding on said main transformer with the same number of turns as said first resonant output winding;

a second sensing primary winding on said gate drive transformer having the same number of turns as said first primary output winding;

wherein a first tap of said second resonant output winding is connected to a first tap of said second sensing primary winding, a second tap of said second resonant output winding is connected through said second rectifier diode to a first load terminal, and a second tap of said second sensing primary winding is connected to said second load terminal;

a second rectifier diode connected between said first load terminal and said second resonant output winding such that said first and second rectifier diodes are oriented in the same direction relative to said load; and

a capacitor connected to the output of said first and second diodes.

4. The converter according to claim 1 further comprising one or more additional loads connected across corresponding additional resonant output windings on said main transformer wherein said first load is required to remain connected in a closed circuit with said first resonant output windings and said first sensing primary winding.

5. The converter according to claim 1 further comprising one or more additional loads connected across corresponding additional output windings on said main transformer;

and a dedicated resonant output winding on said main transformer operatively connected to a corresponding dedicated primary sense winding on said gate drive transformer.

6. The converter according to claim 1 further comprising a compensation capacitor connected between the gate and source of each MOSFET to provide resonant oscillation with said first secondary winding and said second secondary winding.

7. The converter according to claim 1 further comprising a damping resistor connected in series between each of said MOSFET gates and its corresponding secondary winding on said gate drive transformer.

8. An adaptive resonant power converter comprising:

a gate drive transformer comprising a first sensing primary winding, a first secondary winding, and a second secondary winding;;

a first MOSFET having a gate connected to said first secondary winding;

a second MOSFET having a gate connected to said second secondary winding;

said first and second MOSFETS connected to each other in series across a direct current input source and forming a common MOSFET node therebetween at said first MOSFET source and said second MOSFET drain;

an input capacitor connected across said direct current input source and having a first capacitor node connected to said first MOSFET drain and a second capacitor node connected to said second MOSFET source;

a main transformer comprising a primary winding and a first resonant output winding;

said main transformer primary winding connected between said common MOSFET node and said second capacitor node;

wherein a first tap of said first resonant output winding is connected to a first tap of said first sensing primary winding, a second tap of said first resonant output winding is connected to a first load terminal of a first load, and a second tap of said first sensing primary winding is connected to a second load terminal of said first load;

wherein said gate drive transformer further comprises a protection diode winding connected in parallel with a pair of parallel voltage limiting diodes, said voltage limiting diodes having opposite orientations;

a compensation capacitor connected between the gate and source of each MOSFET to provide resonant oscillation with said first secondary winding and said second secondary winding; and

a damping resistor connected in series between each of said MOSFET gates and its corresponding secondary winding on said gate drive transformer.

9. The converter according to claim 3 further comprising one or more additional loads connected across corresponding additional output windings on said main transformer wherein said first load is required to remain connected in a closed circuit with said first resonant output windings and said first sensing primary winding.

10. The converter according to claim 3 further comprising one or more additional loads connected across corresponding additional output windings on said main transformer;

and a dedicated resonant output winding on said main transformer operatively connected to a corresponding dedicated primary sense winding on said gate drive transformer.

11. The converter according to claim 3 further comprising a compensation capacitor connected between the gate and source of each MOSFET to provide resonant oscillation with said first secondary winding and said second secondary winding.

12. The converter according to claim 3 further comprising a damping resistor connected in series between each of said MOSFET gates and its corresponding secondary winding on said gate drive transformer.

13. The converter according to claim 3 wherein said switching transformer further comprises a protection diode winding connected in parallel with a pair of parallel voltage limiting diodes, said voltage limiting diodes having opposite orientations.

14. An adaptive resonant power converter comprising:

a gate drive transformer comprising a first sensing primary winding, a first secondary winding, and a second secondary winding;

a first MOSFET having a gate connected to said first secondary winding;

a second MOSFET having a gate connected to said second secondary winding;

said first and second MOSFETS connected to each other in series across a direct current input source and forming a common MOSFET node therebetween at said first MOSFET source and said second MOSFET drain;

a first and second input capacitor connected to each other in series across said direct current input source and forming a common capacitor node therebetween;

a main transformer comprising a primary winding and a first resonant output winding;

said primary winding connected between said common MOSFET node and said common capacitor node; and

wherein a first tap of said first resonant output winding is connected to a first tap of said first sensing primary winding, a second tap of said first resonant output winding is connected to a first load terminal of said first load, and a second tap of said first sensing primary winding is connected to a second load terminal of said first load.

15. The converter according to claim 14 further comprising

a first rectifier diode connected between said first resonant output winding and said first load terminal;

a capacitor connected across said load from said first load terminal to said second load terminal;

a second output circuit having second resonant output winding on said main transformer with the same number of turns as said first resonant output winding;

a second sensing primary winding on said gate drive transformer having the same number of turns as said first primary output winding;

wherein a first tap of said second resonant output winding is connected to a first tap of said second sensing primary winding, a second tap of said second resonant output winding is connected through said second rectifier diode to a first load terminal, and a second tap of said second sensing primary winding is connected to said second load terminal;

a second rectifier diode connected between said first load terminal and said second resonant output winding such that said first and second rectifier diodes are oriented in the same direction relative to said load.

16. The converter according to claim 14 further comprising one or more additional loads connected across corresponding additional output windings on said main transformer wherein said first load is required to remain connected in a closed circuit with said first resonant output windings and said first sensing primary winding.

17. The converter according to claim 14 further comprising one or more additional loads connected across corresponding additional output windings on said main transformer;

and a dedicated resonant output winding on said main transformer operatively connected to a corresponding dedicated primary sense winding on said gate drive transformer.

18. The converter according to claim 14 further comprising a compensation capacitor connected between the gate and source of each MOSFET to provide resonant oscillation with said first secondary winding and said second secondary winding.

19. The converter according to claim 14 further comprising a damping resistor connected in series between each of said MOSFET gates and its corresponding secondary winding on said gate drive transformer.

20. The converter according to claim 14 wherein said switching transformer further comprises a protection diode winding connected in parallel with a pair of parallel voltage limiting diodes, said voltage limiting diodes having opposite orientations.

21. The converter according to claim 15 further comprising one or more additional loads connected across corresponding additional resonant output windings on said main transformer wherein said first load is required to remain connected in a closed circuit with said first resonant output windings and said first sensing primary winding.

22. The converter according to claim 15 further comprising one or more additional loads connected across corresponding additional output windings on said main transformer;

and a dedicated resonant output winding on said main transformer operatively connected to a corresponding dedicated primary sense winding on said gate drive transformer.

23. The converter according to claim 15 further comprising a compensation capacitor connected between the gate and source of each MOSFET to provide resonant oscillation with said first secondary winding and said second secondary winding.

24. The converter according to claim 15 further comprising a damping resistor connected in series between each of said MOSFET gates and its corresponding secondary winding on said gate drive transformer.

25. The converter according to claim 15 wherein said switching transformer further comprises a protection diode winding connected in parallel with a pair of parallel voltage limiting diodes, said voltage limiting diodes having opposite orientations.

26. A switching power converter comprising a gate drive transformer having a pair of windings having leakage inductance adapted to resonate with gate source capacitance of a corresponding pair of power MOSFETs.

27. The switching power converter according to claim 26 wherein switching is controlled by oscillation of energy between said power MOSFETs.

28. The switching power converter according to claim 26 further comprising a sense winding on said gate drive transformer in series with output of said converter.

29. A method of driving a switching power converter comprising:

matching leakage inductance in a pair of windings of a gate drive transformer with gate-source capacitance of a corresponding pair of power MOSFETs.

30. The method according to claim 29 further comprising sensing converter load with a sensing coil in said gate drive capacitance.

31. A switching power converter comprising means for resonant oscillation between a pair of power MOSFETs.

32. The switching power converter according to claim 1 wherein said means include matched parasitic impedances.